The National Underground Scientific and Engineering Laboratory

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The proposed new deep underground national facility for scientific research holds tremendous promise for many fields of science. Several of these fields are on the threshold of major scientific discoveries in physics, microbiology, and earth sciences to name a few. Recently the Sudbury Neutrino Observatory [1–3] and at KamLAND [4] have convincingly produced evidence for the first new physics beyond the Standard Model in thirty years. Nuclear and high energy physics experiments such as solar neutrino detectors, double beta decay experiments, atmospheric neutrino experiments, proton decay experiments, and dark matter searches were forced to individually find locations, develop the required infrastructure, and develop and operate the experiments as underground sites were found or as opportunities presented themselves. Predominately these experiments have been forced to seek locations outside of the United States. In general these fields share a common feature of not requiring major accelerator facilities or beams and have not enjoyed the typical support and assistance that accelerator based experiments benefit from. The National Underground Scientific and Engineering Laboratory (NUSEL), as proposed to the National Science Foundation, would provide a common infrastructure for underground and non-accelerator experiments as well as providing a synergistic environment for the development of technologies and devices for future research and experiments.

The Nuclear Science Division has a long history in underground research. We have been a major contributor and collaborator in the Sudbury Neutrino Observatory. We more recently joined the KamLAND experiment. The division operates both the Oroville low background facility and the Building 72 facility. Both of these facilities were born with the laboratory's involvement in double beta decay experiments starting nearly forty years ago.

In addition to this involvement in existing experiments and facilities the division has actively led in the establishment of a new national facility NUSEL at the Department of Energy. We have led workshops at the Seattle pre-Townmeeting, organized and led sessions at the Long Range Plan Townmeetings, and co-chaired the joint National Science Foundation and Department of Energy interdisciplinary Committee on *A National Underground Laboratory*. We speared the presentation of an underground lab to the high energy physics community at SNOWMASS and an Aspen workshop. Most recently we actively participated in the NeSS workshop, convened by the National Academy. The conclusions of these meetings and committees have been presented to NSAC, HEPAP, and the National Academy of Sciences and *White Papers* have been published. We are currently on the NUSEL Executive Committee (Lesko) and members of the NUSEL collaboration (Lesko, Poon and Heeger).

The division's interest in NUSEL focuses primarily on future low background counting facilities and double beta decay experiments in the near future and low energy solar neutrinos in the longer term.

The 600 km of drifts in the Homestake mine are presented in Figure 1. The mine is owned by the Barrick Mining Company and is shutting down mine operation. Negotiations between Barrick, the State of South Dakota, the NSF and the NUSEL collaboration [5] are currently seeking the conversion of the mine to a world-class scientific laboratory.

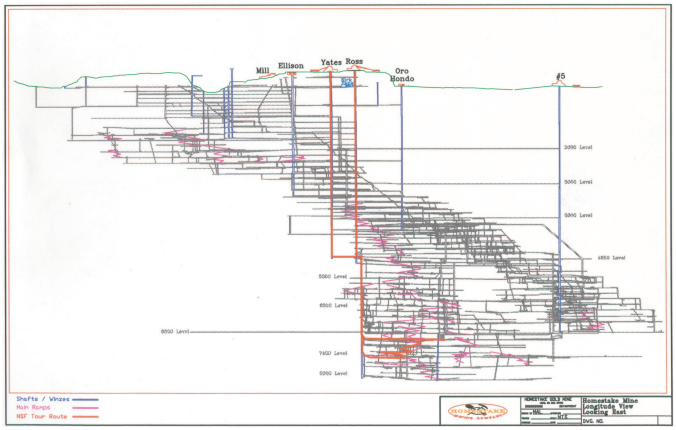

FIG. 1: The Homestake mine, in Lead South Dakota would immediately present access from the surfaced to 8000 feet for scientific research.

Some of the research and future experiments that would be housed at NUSEL and would benefit from the establishment of a deep underground national facility, including double beta decay experiments, low energy solar neutrinos and dark matter experiments, are presented elsewhere in this report.

[1] Q.R. Ahmad *et al.*, Phys. Rev. Lett. **87**, 071301 (2001).
[2] Q.R. Ahmad *et al.*, Phys. Rev. Lett. **89**, 011301 (2002).
[3] Q.R. Ahmad *et al.*, Phys. Rev. Lett. **89**, 011302 (2002).
[4] K. Eguchi *et al.*, Phys. Rev. Lett. **90**, 021802 (2003).
[5] http://int.phys.washington.edu/NUSEL/